

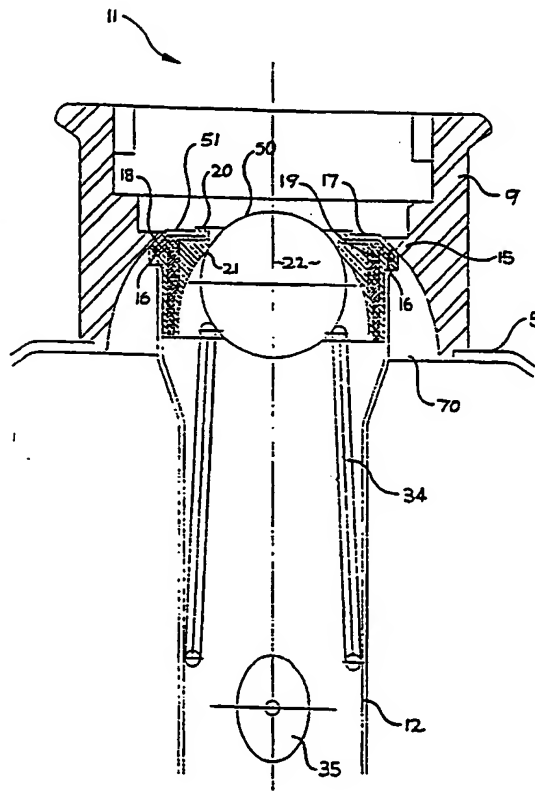
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(21) International Application Number: PCT/AU90/00279 (22) International Filing Date: 29 June 1990 (29.06.90) (30) Priority data: PJ 4997 29 June 1989 (29.06.89) AU (71)(72) Applicants and Inventors: SKERRA, Helmut [DE/AU]; 7 St. James Road, Varroville, NSW 2565 (AU). KARAN, George [AU/AU]; 77 John Street, Woollahra, NSW 2025 (AU). (74) Agent: SHELSTON WATERS; 55 Clarence Street, Sydney, NSW 2000 (AU). (81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CM (OAPI patent), DE*, DE (European patent)*, DK, DK (European patent), ES, ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent)			patent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL, NL (European patent), NO, RO, SD, SE, SE (European patent), SN (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent), US. Published <i>With international search report.</i>

(54) Title: A VALVE ASSEMBLY

(57) Abstract

A storage apparatus (1) for storing and selectively dispensing fluid, said apparatus including: a substantially closed container (2) having sides, a top (5) and a bottom (6); a neck (9) formed integrally with the top such that the neck and container form a unitary structure; a valve assembly (11) housed generally within the neck to selectively seal the container; and an internal supply tube (12) extending from the valve assembly to a region adjacent the bottom of the container; said valve assembly comprising: a first inwardly extending generally annular peripheral flange (15) formed integrally with the neck and defining a first valve seat (16) cooperable with a first valve member (17) movable between a closed position in sealing abutment with the first valve seat and an open position away from the first valve seat to permit fluid flow between the exterior and the interior of the container; a second valve seat (21) associated with said first valve member and cooperable with a second valve member (22) movable between a closed position in sealing abutment with said second valve seat and an open position away from the second valve seat to permit fluid flow between the exterior of the container and the supply tube, such that the first peripheral flange captively retains the first and second valve members to prevent outward withdrawal of the valve assembly through the neck; and bias means to resiliently urge the respective first and second valve members toward their closed positions; the valve assembly being selectively actuatable to permit the container to be emptied or filled.



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Title: "A VALVE ASSEMBLY"

FIELD OF THE INVENTION

The present invention relates to a storage apparatus for containing, transporting, and selectively dispensing fluids under pressure.

The invention has been developed primarily for use with beer kegs and will generally be described hereinafter with reference to this application. However, it will be appreciated that the invention is not limited to this particular field of use. For example, the invention is also suitable for use in the storage of chemicals, industrial gases, soft drinks, and other fluids.

BACKGROUND OF THE INVENTION

Storage kegs for beer and other fluids are known and generally comprise a container or drum incorporating a valve assembly through which the keg is alternately

emptied and filled. In the past, the valve assembly has been releaseably retained within a neck of the container by means of a circlip or screw thread and complementary O-ring seals. However, this arrangement has several inherent disadvantages.

Firstly, the prior art valve assemblies are easily removable by unskilled or unauthorised persons which permits interference with the contents of the container. This situation is potentially hazardous for the unskilled person tampering with the container, particularly where the contents is stored under pressure, and exposes the product to the risk of contamination.

Furthermore, known valve assemblies used with conventional kegs have a tendency to leak, particularly during transportation. This problem arises partly because of the difficulty with conventional designs of maintaining a good compression seal between the valve assembly and the neck and partly because of the tendency for the free end of the internal supply tube or spear to move and thereby displace the sealing gaskets and O-rings to permit leakage.

Such leakage facilitates the growth of bacteria and the accumulation of other contaminants around the neck and valve assembly of the keg, making hygienic transportation and dispensing of fluids practically impossible. Moreover, it has been found that the

bacteria and other contaminants residing in the interstices between the mating screw threads or adjacent the circlips and O-rings of the conventional valve assemblies are usually not removed during the normal cleaning process.

It is therefore an object of the present invention to provide an improved storage container which overcomes or substantially ameliorates at least some of the above-mentioned disadvantages of the prior art.

DISCLOSURE OF THE INVENTION

Accordingly, in a first aspect, the present invention provides a storage apparatus for storing and selectively dispensing fluid, said apparatus including: a substantially closed container having a top and a bottom; a neck formed integrally with the top such that the neck and container form a unitary structure; a valve assembly housed generally within the neck to selectively seal the container; and an internal supply tube extending from the valve assembly to a region adjacent the bottom of the container;

said valve assembly comprising: a first inwardly extending generally annular peripheral flange formed integrally with the neck and defining a first valve seat cooperable with a first valve member moveable between a closed position in sealing abutment with the first valve seat and an open position away from the first valve seat to permit fluid flow between the exterior and the

interior of the container; a second valve seat associated with said first valve member and cooperable with a second valve member moveable independently of the first between a closed position in sealing abutment with said second valve seat and an open position away from the second valve seat to permit fluid flow between the exterior of the container and the supply tube, such that the first peripheral flange captively retains the first and second valve members to prevent outward withdrawal of the valve assembly through the neck; and bias means to resiliently urge the respective first and second valve members toward their closed positions; the valve assembly being selectively actuatable to permit the container to be emptied or filled.

Preferably, the neck comprises a generally tubular collar extending upwardly from a corresponding aperture formed in the top of the container and adapted for cooperative engagement with a complementary adaptor coupling of a suitable filling device whereby the container is emptied or filled.

In a first preferred embodiment of the invention, the first valve member is integral with the supply tube and preferably includes an upwardly converging generally frusto-conical outwardly depending valve face adapted for mutual sealing engagement with the first valve seat integral with the neck. The first valve member preferably also includes an inwardly depending generally

annular peripheral flange defining the second valve seat. The second valve member preferably includes a substantially spherical valve face adapted for sealing abutment with the second valve seat.

In this embodiment, the apparatus preferably includes locating means mounted to the bottom of the container to positively locate the proximate end of the supply tube. The locating means preferably comprises a spigot extending upwardly from the bottom of the container to nestingly engage a lower portion of the supply tube.

The bias means of the valve assembly preferably includes a first spring extending between the spigot and corresponding engagement formations on the supply tube to bias the tube upwardly and thereby resiliently urge the first valve member towards its closed position. A second spring cooperable with the first and extending between the second valve member and corresponding engagement formations on the supply tube acts independently of the first to bias the second valve member towards its closed position.

In an alternative embodiment, the first valve member preferably comprises a generally annular sleeve slideably mounted to the upper end of the supply tube and having a first recessed outer peripheral shoulder defining a first upwardly depending valve face adapted for sealing abutment with the first valve seat on the

flange formed integrally with the neck. The first valve member preferably includes a second upwardly depending recessed annular shoulder on its inner periphery defining the second valve seat.

The second valve member preferably comprises an annular retaining flange extending radially outwardly from the upper terminal end of the supply tube to resist upward withdrawal of the first valve member from the supply tube. The retaining flange defines a downwardly depending second valve face adapted for sealing abutment with the second valve seat formed in the first valve member.

In this alternative embodiment, the bias means preferably includes a single compression spring extending between the first valve member and corresponding engagement formations on the supply tube to bias the first valve member upwardly relative to the supply tube and into abutting engagement with the retaining flange thereby to effectively resiliently urge the second valve member towards its closed position. The engagement formations on the supply tube are preferably adapted for engagement with corresponding internal locating formations on the neck such that the first valve member is simultaneously biased upwardly relative to the neck by the compression spring. In this way, the spring simultaneously urges the first valve member towards its closed position in sealing engagement

with the first valve seat formed in the peripheral flange depending radially inwardly from the neck.

According to a second aspect, the present invention provides a method of forming a storage apparatus substantially as described above, said method including the steps of:

joining the sides, top, and bottom to form the container;

forming an opening in the top and a corresponding opening in the bottom of the container;

forming the neck around the top opening such that the neck is integral with the top and the neck and container together form a unitary structure;

passing the valve assembly through the bottom opening and locating the valve assembly sealingly within the neck; and

thereafter sealingly closing the bottom opening to prevent subsequent withdrawal of the valve assembly from the container.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a sectional side elevation showing a storage apparatus according to a first embodiment of the invention;

Figure 2 is an enlarged cross-sectional view

showing the valve assembly of the storage apparatus of figure 1;

Figure 3 is an enlarged sectional view showing the valve assembly and locating means in the form of a spigot connected with the internal supply tube of the storage apparatus of figure 1;

Figure 4 is an enlarged sectional view showing the valve assembly and an alternative form of the locating means of figure 3;

Figure 5 is a sectional side elevation showing an alternative embodiment of the storage apparatus of figure 1;

Figure 6 is an enlarged sectional view showing the valve assembly of figure 5;

Figure 7 is an enlarged sectional view showing a third embodiment of the valve assembly;

Figure 8 is an exploded part-sectional view of the valve assembly of figure 7.

PREFERRED EMBODIMENTS OF THE INVENTION

Referring firstly to figures 1 to 3, the invention resides in a storage apparatus 1 for storing and selectively dispensing beer, soft drinks, water, industrial gases, or other suitable fluid. The apparatus includes a generally cylindrical substantially closed container 2 having a top 5, a bottom 6, and sides 7 extending between the top and bottom. The apparatus further includes a neck 9 formed integrally with the top

such that the neck and container together form a unitary structure. The neck 9 comprises a generally tubular collar extending upwardly from a corresponding aperture formed in the top of the container and adapted for releasable engagement with a complementary adaptor coupling of a suitable filling device (not shown) of the conventional type.

A valve assembly 11 is housed generally within the neck to selectively seal the container and an internal supply tube 12 extends downwardly from the valve assembly 11 to a region adjacent the bottom of the container. The valve assembly is selectively actuatable in conjunction with the filling or dispensing device by means of differential pressure to permit the container to be selectively emptied or filled. In this way the contents of the apparatus can be safely and conveniently stored, transported, and dispensed.

The valve assembly 11 comprises a first inwardly extending generally annular peripheral flange 15 formed integrally with the neck and defining a first downwardly depending valve seat 16 cooperable with a first valve member 17 in the form of a sleeve formed integrally with the upper end of the supply tube 12. The sleeve is formed from resilient plastics material or rubber and includes a supporting metal insert 19 to prevent excessive resilient deformation. The resilient sleeve incorporates an upwardly converging generally

frusto-conical valve face 18 adapted for sealing engagement with the first valve seat 16. The first valve member 17 is movable between a closed position (as shown) in sealing abutment with the first valve seat 16 and an open position away from the valve seat to define a first annular passage (not shown) permitting fluid flow between the interior and the exterior of the container.

The first valve member 17 includes an inwardly extending generally annular peripheral flange 20 defining a second downwardly depending valve seat 21 cooperable with a second substantially spherical valve member 22 disposed generally within the sleeve. Spherical valve member 22 is movable between a closed position in sealing abutment with the second valve seat 21 (as shown) and an open position away from its respective valve seat to define a second generally annular passage (not shown) permitting fluid flow between the exterior of the container and the supply tube 12 through the neck.

It will be appreciated from the drawings that the first peripheral flange 15 extends radially inwardly from the neck to captively retain the first 17 and second 22 valve members and thereby prevent outward withdrawal of the valve assembly 11 through the neck, once the apparatus has been assembled and sealed.

Locating means in the form of spigot 30 extends

upwardly from the bottom 6 of the container to nestingly engage and positively locate a lower portion of the supply tube 12. The spigot 30 includes a plurality of apertures (not shown) to permit fluid flow between the interior of the container and the tube.

A first compression spring 32 extends between spigot 30 and corresponding engagement formations 33 on the lower end of the supply tube to bias the tube upwardly and thereby resiliently urge the first valve member 17 toward its closed position. A second compression spring 34 extends between the second spherical valve member 22 and corresponding engagement formations 35 on the upper end of the supply tube to independently bias the spherical valve member toward its closed position. Figure 4 shows an alternative form of locating means wherein the spigot 30 and compression spring 32 are effectively integral.

Figure 5 shows an alternative form of the valve assembly 11. In this embodiment, the upper portion of the supply tube 12 is housed within a generally cylindrical retaining cup 40 extending downwardly from within the neck and incorporating an inwardly extending annular flange 41. In this case, compression spring 42 is disposed between the lower flange 41 of retaining cup 40 and the flared end portion 45 of the supply tube. Thus, spring 42 performs a function analogous to that of spring 32 of figure 3 to bias the tube upwardly and

thereby resiliently urge the first valve member 17 towards its closed position.

Turning now to describe the operation of the storage apparatus in a preferred application as a beer keg, in order to fill the container, pressure is applied against the upper surface 50 of spherical valve member 22 by the coupling assembly of the filling device in order to open the second annular passage defined between the second valve member 22 and its corresponding valve seat 21. Similarly, pressure is applied to the upper annular surface 51 of first valve member 17 to open the first annular passage defined between the first valve member and the surrounding flange 15. The keg is then filled with beer through the first outer passage whilst air from within the container is simultaneously exhausted through the supply tube via the second concentric inner passage. The keg is subsequently transported to the point of use.

In order to dispense beer from the keg, a conventional tap assembly is fitted to the neck so as to engage and selectively actuate the valve assembly. In this case, however, compressed air is supplied through the first outer passage defined between the first valve member 17 and surrounding flange 15 in order to pressurise the keg. The beer then rises upwardly through supply tube 12 and outwardly through the second inner passage defined between the second valve member 22

and its corresponding valve seat 21 to a dispensing tap. Thus, the first and second annular concentric passages defined between the respective valve members in their open positions permit simultaneous counter-flow of pressurising gas and fluid in and out of the container in a manner well understood by those skilled in the art.

Figures 7 and 8 show an alternative embodiment of the invention wherein corresponding features are denoted by corresponding reference numerals. In this form of the invention, the first valve member 17 includes a generally annular resilient sleeve 50 slidably mounted to the upper end of the supply tube. The sleeve 50 has a first stepped outer peripheral shoulder 51 defining the first valve face 18 adapted for sealing engagement with the first valve seat 16 formed integrally with the neck as previously described. The sleeve 50 further includes a second concentric stepped shoulder 52 on its inner periphery defining the second upwardly depending valve seat 21.

The second valve member 22 in this case is not spherical as in the previous embodiments, but comprises an annular retaining flange 55 extending radially outwardly from the upper terminal end of the supply tube 12 to resist upward withdrawal of the first valve member from the supply tube. The second valve member 22 in the form of retaining flange 55 is adapted for sealing engagement with the corresponding recessed annular

shoulder 52 of the second valve seat 21 formed on the sleeve 50. As in the previous embodiments, the respective valve seats, valve members, and supply tube, are coaxial with the neck. In this configuration, the upper terminal end of the supply tube is closed and fluid is permitted to flow into and out of the tube by means of a peripheral array of ports 56 formed in a portion of the side wall of the tube disposed within the neck.

In this case, however, the bias means comprises a single compression spring 60 disposed concentrically around the supply tube and extending between an upper retaining cup 61 forming the lower face of sleeve 50 and a lower retaining flange 62 extending radially outwardly from the supply tube. The spring 60 urges the sleeve 50 upwardly relative to the supply tube and into abutting engagement with the retaining flange 55 thereby to effectively resiliently bias the second valve member toward its closed position relative to the second valve seat 21 formed in the first valve member 17.

The lower retaining flange 62 preferably includes a plurality of peripherally spaced outwardly extending lugs (not shown) adapted for releasable engagement with corresponding internal locating formations (also not shown) on adjacent neck portion 66 as a bayonet type fitting. In this way, the first valve member in the form of sleeve 50 is simultaneously biased upwardly

relative to the neck by means of spring 60 thereby to resiliently urge the first valve member towards the closed position in sealing engagement with its corresponding valve seat formed in the peripheral flange 15 extending radially inwardly from the neck. Thus, the single spring 60 acts to resiliently bias both the first and second valves towards their closed positions. In an alternative embodiment, retaining flange 62 may simply be permanently welded to surrounding neck portion 66.

Turning now to describe the method of forming the storage apparatus, the top 5, bottom 6 and sides 7 are first joined to form the container having top and bottom openings 70 and 71. Neck 9 is then formed around the top opening 70 such that the neck is integral with the top and the neck and container together form a unitary structure as previously described.

The valve assembly 11 is then passed through the bottom opening 71 and located sealingly in position within the neck. The bottom opening 71 is then closed by means of welding, or insertion of a suitable plug to prevent subsequent withdrawal of the valve assembly from the container without considerable difficulty and without permanent evidence of tampering.

This method of construction provides an improved storage apparatus and associated valve system which is highly reliable in use and effectively tamper-free so that the possibility of interference or contamination of

the fluid contents is significantly reduced. The improved design obviates the need for a separate sealing arrangement to releasably retain the valve assembly within the neck and thus requires fewer parts. This consequently improves reliability, reduces manufacturing costs, provides optimum flow rates, and facilitates cleaning, decontamination and sterilisation by eliminating the interstices between the mating screw threads or circlips and O-rings of the conventional valve sealing mechanisms of the prior art and thereby inhibiting the growth of bacteria and the accumulation of other contaminants around the neck and valve assembly. The overall design provides a quantum improvement in terms of hygiene, pressurisation safety and security from tampering. Thus, the present invention represents a commercially significant improvement over the prior art.

Although the invention has been described with reference to specific examples, it will be appreciated by those skilled in the art that the invention may be embodied in many other forms.

CLAIMS:-

1. A storage apparatus for storing and selectively dispensing fluid, said apparatus including: a substantially closed container having a top and a bottom; a neck formed integrally with the top such that the neck and container form a unitary structure; a valve assembly housed generally within the neck to selectively seal the container; and an internal supply tube extending from the valve assembly to a region adjacent the bottom of the container;

said valve assembly comprising: a first inwardly extending generally annular peripheral flange formed integrally with the neck and defining a first valve seat cooperable with a first valve member moveable between a closed position in sealing abutment with the first valve seat and an open position away from the first valve seat to permit fluid flow between the exterior and the interior of the container; a second valve seat associated with said first valve member and cooperable with a second valve member moveable independently of the first between a closed position in sealing abutment with said second valve seat and an open position away from the second valve seat to permit fluid flow between the exterior of the container and the supply tube, such that the first peripheral flange captively retains the first and second valve members to prevent outward withdrawal of the valve assembly through the neck; and bias means

to resiliently urge the respective first and second valve members toward their closed positions; the valve assembly being selectively actuatable to permit the container to be emptied or filled.

2. A storage apparatus according to claim 1 wherein the neck comprises a generally tubular collar extending upwardly from a corresponding aperture formed in the top of the container and adapted for cooperative engagement with a complementary adapter coupling of a suitable filling device.

3. A storage apparatus according to claim 2 wherein the first and second valve seats are substantially annular and concentric.

4. A storage apparatus according to claim 3 wherein the first valve member is integral with the supply tube and includes an upwardly converging generally frusto-conical valve face adapted for mutual sealing engagement with the first valve seat.

5. A storage apparatus according to claim 4 wherein the first valve member includes a second inwardly extending generally annular peripheral flange defining the second valve seat.

6. A storage apparatus according to claim 5 wherein the second valve member includes a substantially spherical valve face adapted for mutual sealing engagement with the second valve seat.

7. A storage apparatus according to claim 6 wherein

- the first and second valve seats and first and second valve members are substantially co-axial with the neck.
8. A storage apparatus according to claim 7 further including locating means mounted to the bottom of the container to positively locate the proximate end of the supply tube.
9. A storage apparatus according to claim 8 wherein the locating means comprises a spigot extending upwardly from the bottom of the container to nestingly engage a lower portion of the supply tube and permit fluid flow between the interior of the container and the tube.
10. A storage apparatus according to claim 9 wherein said bias means includes a first spring extending effectively between the container and corresponding engagement formations on the supply tube to bias the tube upwardly and thereby resiliently urge the first valve member toward its closed position, and a second spring extending between the second valve member and corresponding engagement formations on the supply tube to resiliently urge the second valve member towards its closed position.
11. A storage apparatus according to claim 1 wherein the first valve member comprises a sleeve formed from resilient plastics material or rubber.
12. A storage apparatus according to claim 11 wherein the sleeve includes a metal insert to prevent excessive resilient deformation.

13. A storage apparatus according to claim 11 wherein the second valve member is substantially spherical and is housed generally within said sleeve.
14. A storage apparatus according to any one of claims 1 to 3 wherein the first valve member includes a generally annular sleeve slideably mounted to the upper end of the supply tube and having a first stepped outer peripheral shoulder defining a first upwardly depending valve face adapted for mutual sealing engagement with a the first valve seat formed in the neck.
15. A storage apparatus according to claim 14 wherein the first valve member includes a second upwardly depending stepped shoulder on the inner periphery thereof defining the second valve seat.
16. A storage apparatus according to claim 15 wherein the second valve member comprises an annular retaining flange extending radially outwardly from the upper terminal end of the supply tube to resist upward withdrawal of the first valve member from the supply tube and adapted for mutual sealing engagement with the second valve seat formed in the first valve member.
17. A storage apparatus according to claim 16 wherein the first and second valve seats, and the first and second valve members, are co-axial with the neck.
18. A storage apparatus according to claim 17 wherein said bias means includes a compression spring extending between the first valve member and corresponding

engagement formations on the supply tube to bias the first valve member upwardly relative to the supply tube and into abutting engagement with the retaining flange thereby to effectively resiliently urge the second valve member toward its closed position relative to the second valve seat formed in the first valve member.

19. A storage apparatus according to claim 18 wherein said engagement formations on the supply tube are adapted for engagement with corresponding internal locating formations on the neck such that the first valve member is simultaneously biased upwardly relative to the neck by said compression spring thereby to resiliently urge the first valve member toward its closed position in sealing engagement with the first valve seat formed in the peripheral flange extending inwardly from the neck.
20. A storage apparatus according to claim 19 wherein the upper terminal end of the supply tube is closed and fluid is permitted to flow into and out of the tube by means of a peripheral array of ports formed in a portion of the side wall of the tube disposed within the neck.
21. A storage apparatus according to claim 20 wherein the engagement formations on the supply tube are adapted for releasable engagement with the corresponding locating formations on the neck by means of a bayonet type fitting.
22. A storage apparatus according to claim 14 wherein

the first valve member comprises a sleeve formed from resilient plastics material or rubber.

23. A storage apparatus according to claim 22 wherein the sleeve includes a metal insert to prevent excessive resilient deformation.

24. A method of forming a storage apparatus according to any one of the preceding claims, said method comprising the steps of:

joining the sides, top, and bottom to form the container;

forming an opening in the top and a corresponding opening in the bottom of the container;

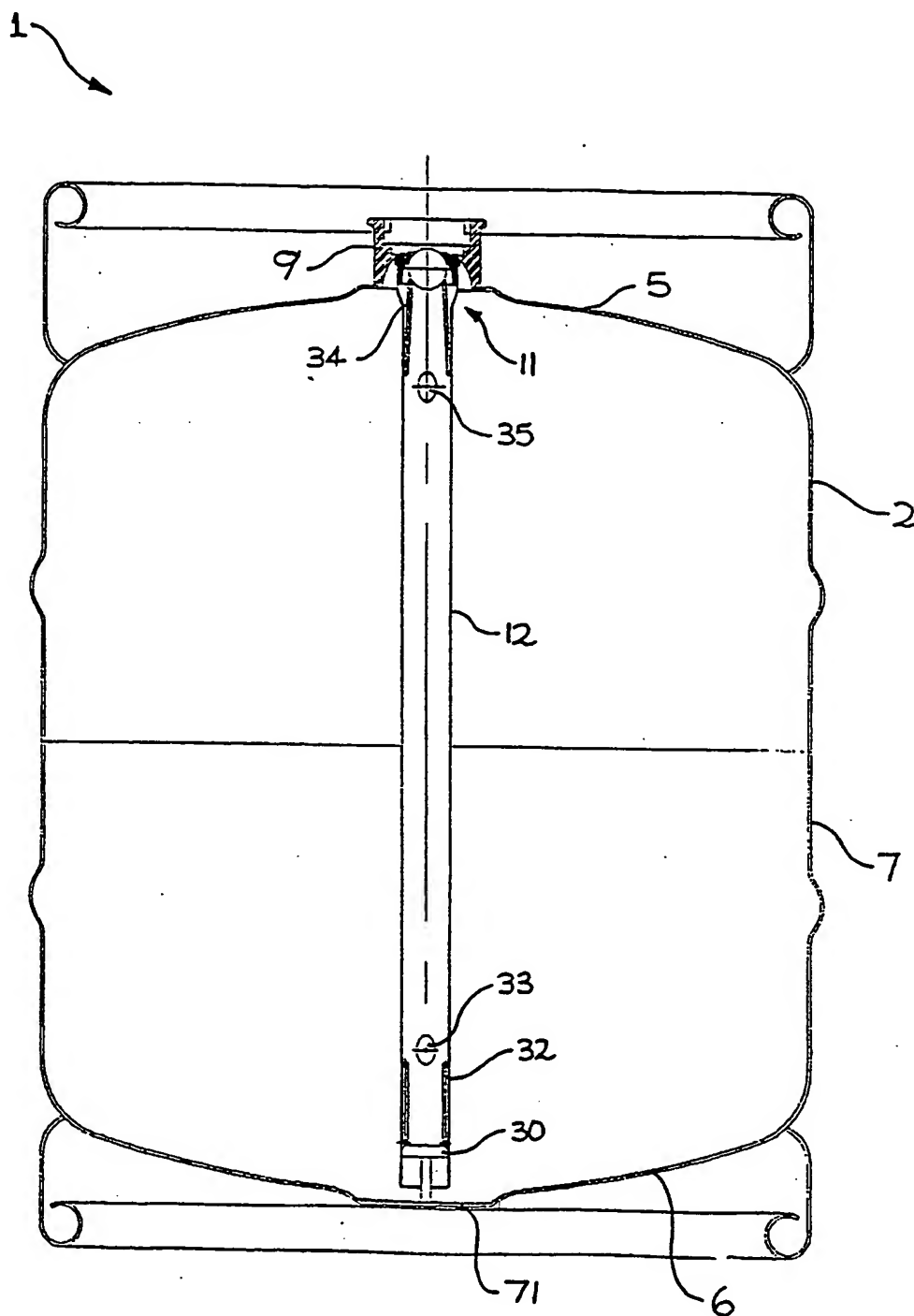
forming the neck around the top opening such that the neck is integral with the top and the neck and container together form a unitary structure;

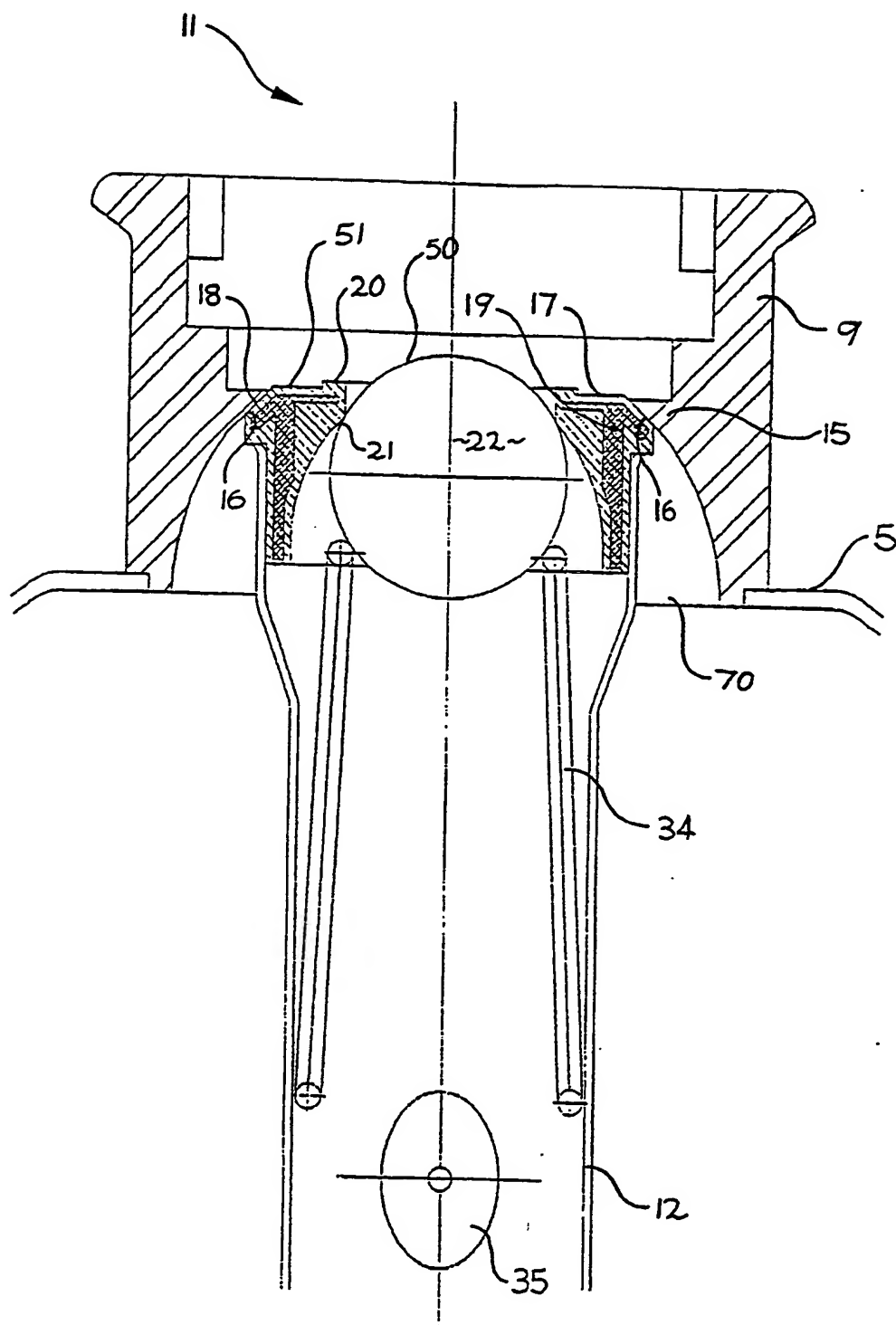
passing the valve assembly through the bottom opening and locating the valve assembly sealingly within the neck; and

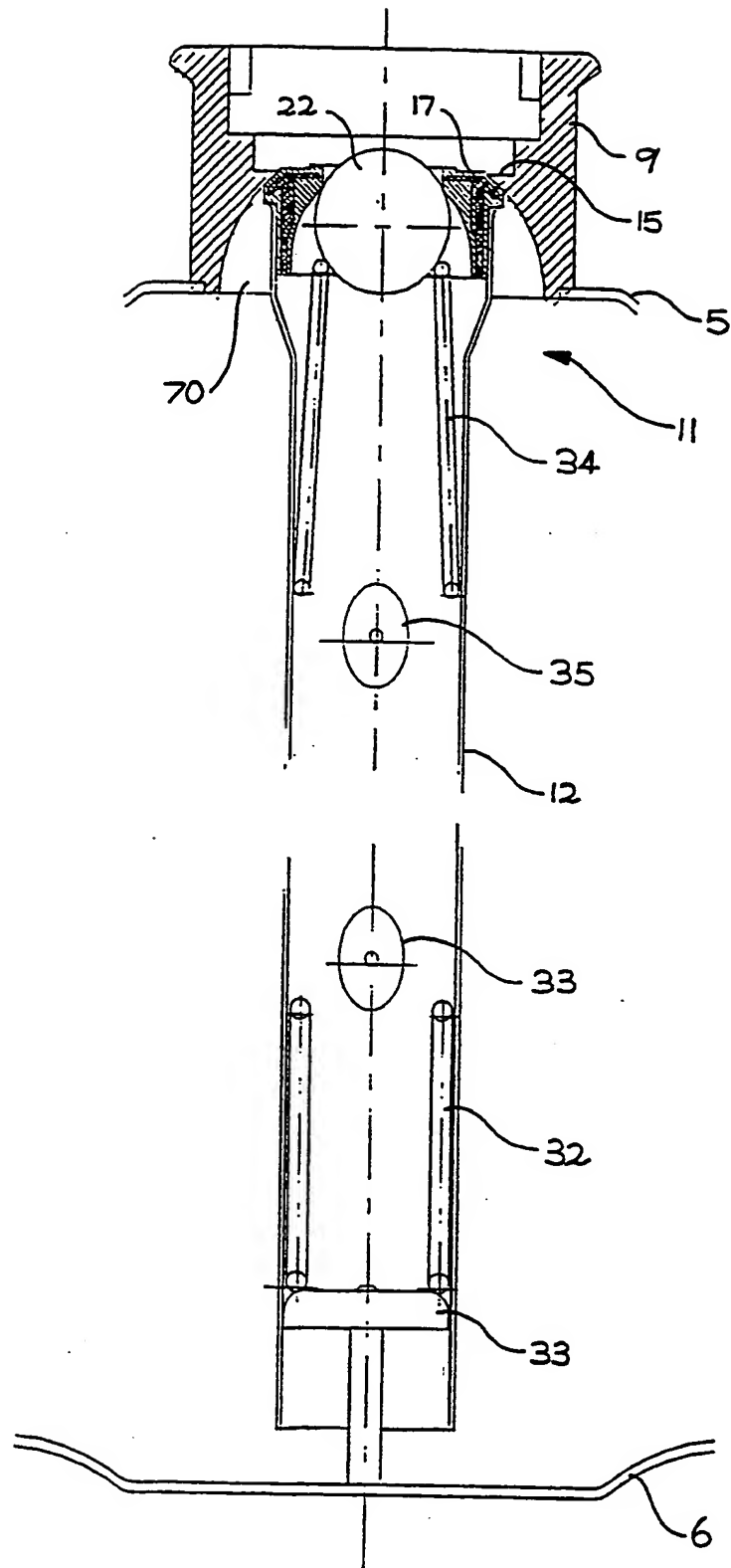
thereafter sealingly closing the bottom opening to prevent subsequent withdrawal of the valve assembly from the container.

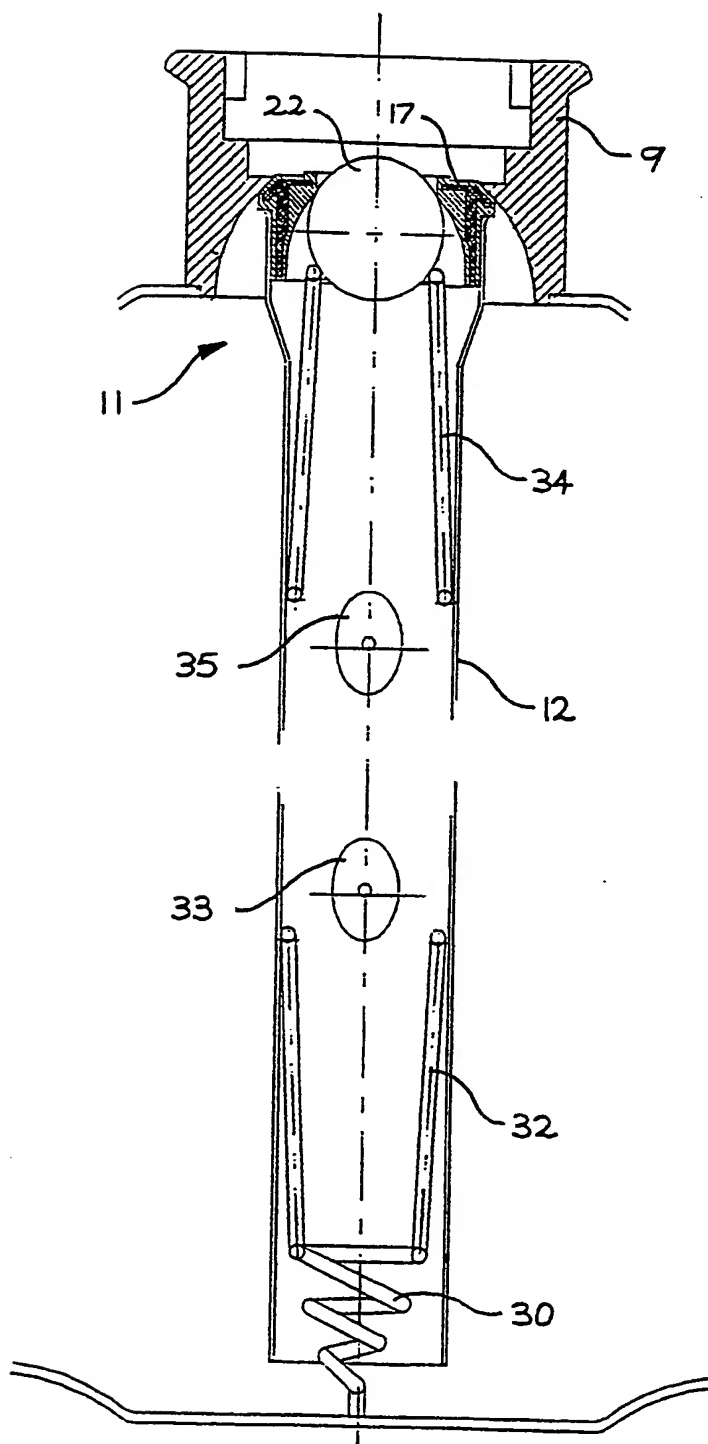
25. A storage apparatus substantially as hereinbefore described with reference to figures 1 to 3, 4, 5 and 6, or figures 7 and 8 of the accompanying drawings.

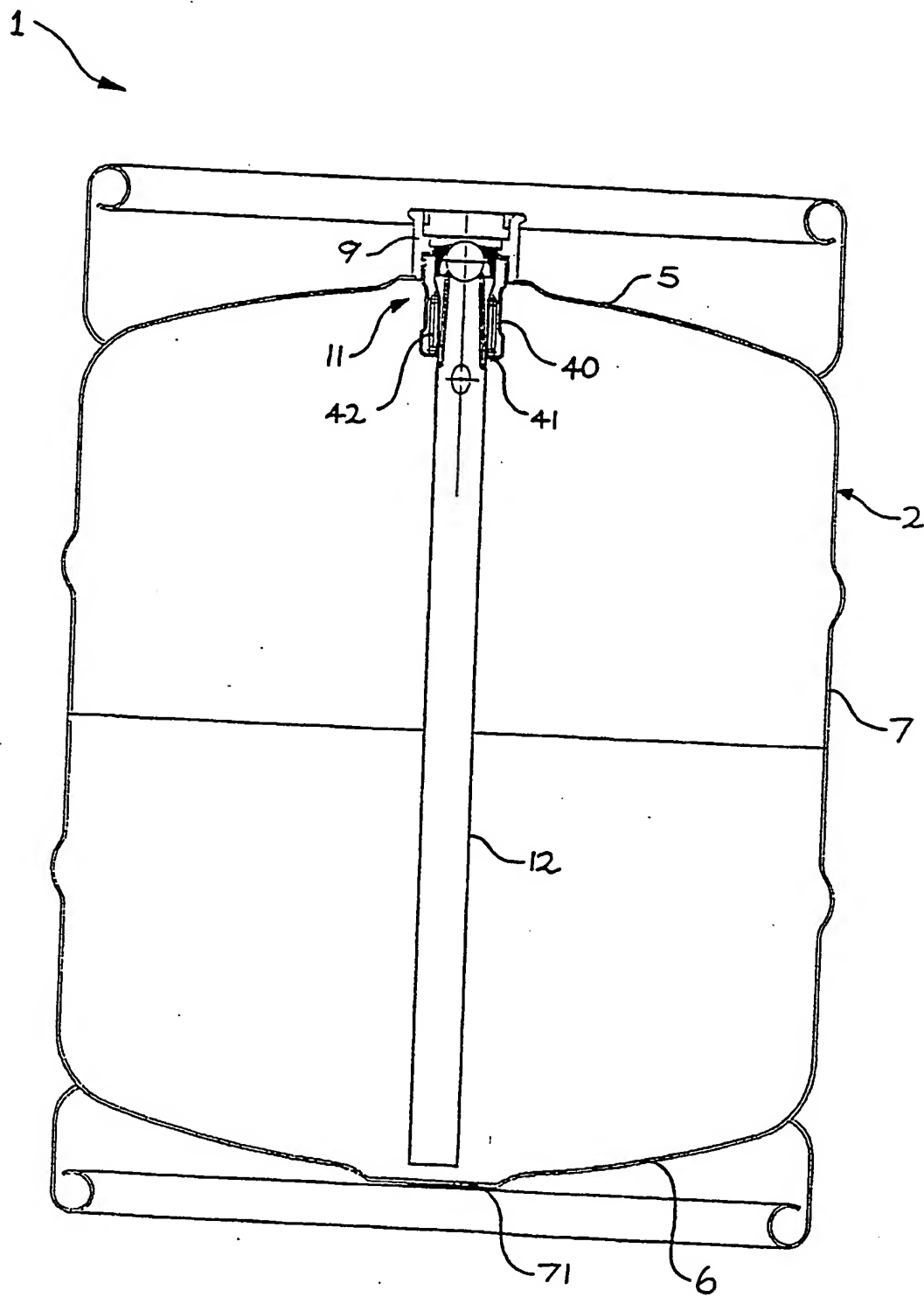
26. A method of forming a storage apparatus, said method being substantially as hereinbefore described with reference to the accompanying drawings.

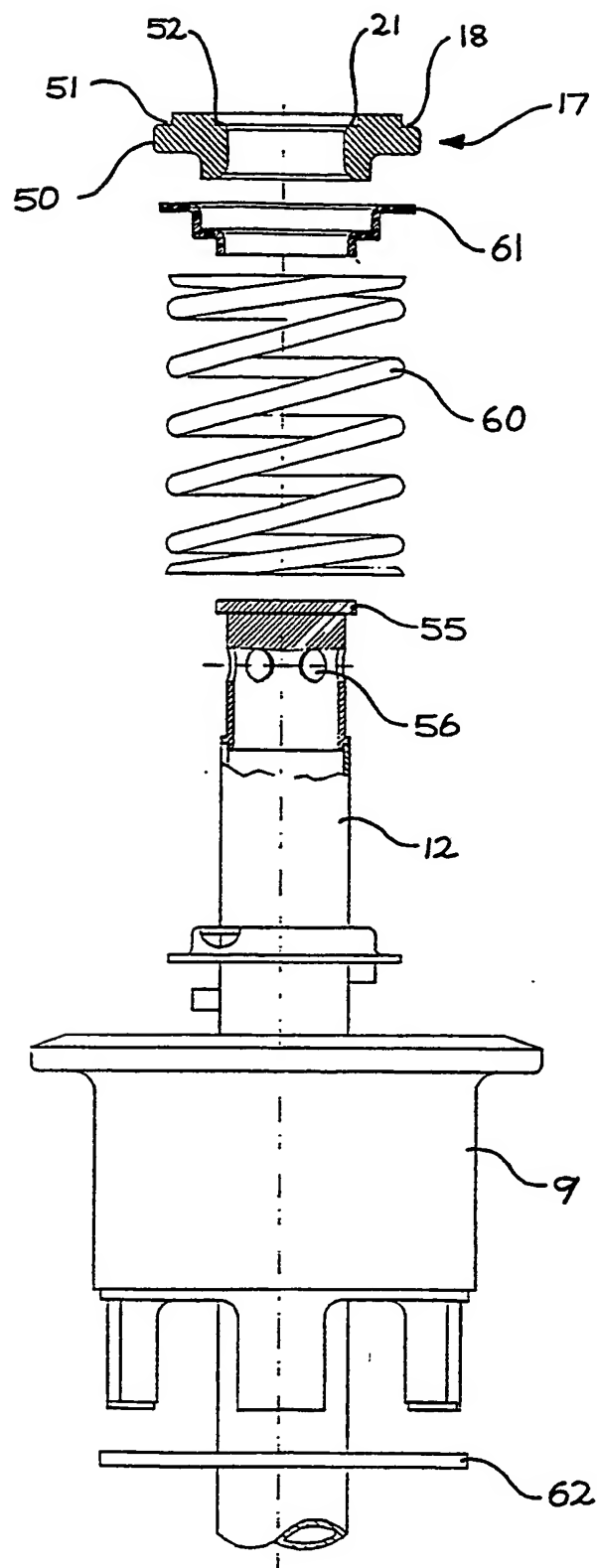
FIG 1



FIG 3

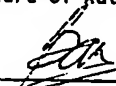
FIG 4

FIG 5

FIG 8

INTERNATIONAL SEARCH REPORT

International Application No. PCT/AU 90/00279

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) 6		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int. Cl. ⁵ B67D 1/04, 1/12		
II. FIELDS SEARCHED		
Minimum Documentation Searched 7		
Classification System	Classification Symbols	
IPC	B67D 1/04, 1/12	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched 8		
AU : IPC as above		
III. DOCUMENTS CONSIDERED TO BE RELEVANT 9		
Category*	Citation of Document, with indication, where appropriate, of the relevant passages 12	Relevant to Claim No 13
X	AU,A, 65075/86 (JOHNSON ENTERPRISES) 21 May 1987 (21.05.87) See Fig 3	(1-26)
X	AU,B, 32144/78 (514788) (GKN SANKEY LTD) 12 July 1979 (12.07.79) See Figs 1-5	(1-26)
X	AU,B, 32326/78 (518262) (GKN SANKEY LTD) 19 July 1979 (19.07.79) See Figs 1-3	(1-26)
X	AU,A, 86011/82 (DRAFT SYSTEMS INC) 6 October 1983 (06.10.83) See Fig 1	(1-26)
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IV. CERTIFICATION		
Date of the Actual Completion of the International Search 20 September 1990 (20.09.90)	Date of Mailing of this International Search Report 4 October 1990	
International Searching Authority Australian Patent Office	Signature of Authorized Officer <div style="text-align: center;">  P. WARD </div>	

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON
INTERNATIONAL APPLICATION NO. PCT/AU 90/00279

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Patent Document Cited in Search Report		Patent Family Members		
AU 65075/86	CA 1271456 US 4665940	EP 225035	JP 62122989	
AU 86011/82	US 4509663			
AU 32326/78	DE 2737500 JP 53025187	DK 3698/77 US 4142658	GB 1577117	

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